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Journal of the Society of Arts.

FRIDAY, SEPTEMBER 25, 1868.

Announcements by the Council.

Examinations, 1869.

The Programme of Examinations for 1869 is now published, and may be had *gratis* on application to the Secretary of the Society of Arts.

Prizes.

The Council, at the suggestion of the Food Committee, offer the following prizes for Improved Railway Meat Vans, Milk Vans, and Milk Cans :—

1. For an improved method of conveying meat by rail, the Society's *Silver Medal* and £10.

The object in view is to reduce to a minimum the deterioration which meat now suffers in its transit by rail. The principal evils to be avoided are—excessive changes of temperature, and injuries by pressure, by handling, exposure to dust, insects, &c. This prize may be awarded for an improved railway meat van or for a travelling meat larder suitable for railways.

Model on a scale of half an inch to a foot to be sent in.

2. For an improved method of conveying milk cans by by rail, the Society's *Silver Medal* and £10.

The object in view is to reduce to a minimum the deterioration which milk now suffers in its transit by rail in the ordinary open trucks. The principal evils to be avoided are—the heating and shaking of the milk cans.

Model of an improved railway milk van, on a scale of half an inch to the foot, to be sent in.

3. For an improved railway milk can, the Society's *Silver Medal* and £10.

The object in view is to reduce to a minimum the deterioration which milk now suffers in its transit by rail in the ordinary milk cans, or " churns." The principal evils to be avoided are—the heating of the milk, and all motion within the can which may cause the buttery particles to separate.

A specimen of the improved railway milk-can to be sent in.

The models and specimens for competition must be forwarded to the Secretary of the Society of Arts before the 1st February, 1869.

Harvesting Corn in Wet Weather.

The Essay by Mr. W. A. Gibbs, of Gillwell-park, Sewardstone, Essex, for which the Gold Medal of the Society and a prize of Fifty Guineas were awarded, is now ready. Published by Messrs. Bell and Daldy, York-street, Covent-garden, publishers to the Society of Arts; price one shilling, illustrated by woodcuts.

Subscriptions.

The Midsummer subscriptions are due, and should be forwarded by cheque or Post-office order, crossed " Coutts and Co.," and made payable to Mr. Samuel Thomas Davenport, Financial Officer.

Proceedings of the Society.

Cantor Lectures.

"On Food." By Dr. Letheby, M.A., M.B., &c.

Lecture IV., delivered Monday, February 10th.

Preservation of Food—Unwholesome and Adulterated Food.

(*Continued from page* 748).

I come now to the last division of our subject—namely, that which relates to the sale and use of *unsound* and *adulterated food ;* and perhaps the most important of this kind of food is *bad meat*—that is, meat which is unwholesome on account of putridity or disease. Food of this description has always been a subject of legal prohibition. Among the Jews the prohibition dates from the time of Moses, who is supposed to have received from the Lord, during his sojourn upon Mount Sinai, certain oral commandments respecting the slaughtering of animals for food, and the examination of their bodies for disease. There is no account of these commandments in the written law, but they were evidently communicated to the people of Israel by Moses, for he says, " thou shalt kill of thy herd, and of thy flock, which the Lord hath given thee, *as I have commanded thee*—(Deut., chap. xii., v. 21). It is presumed, therefore, that these instructions were very specific, and they have been practised by the Jews from that time until now. The Hebrew law is, that no flesh shall be eaten, except of animals that have been killed and searched, or examined, by the officer (*bodek*) appointed for that purpose; and the most precise rules are laid down for his guidance in these matters. In fact, he is bound by very solemn obligations to declare of every animal that he kills, whether the flesh is proper to be eaten (*caser*), or is unfit for food, by reason of its being diseased or torn (*trefa*). This expression appears to have been derived from an ordinance of Moses, that no flesh should be eaten that is torn in the field (Exodus, chap. xxii., v. 31) ; the word torn (*trefa* or *terefa*) being supposed, according to the traditions of Hebrew sages, to apply not only to animals torn in the chase, or by wild beasts, or by the bungling act of the butcher, but also to those affected with any disease that would shorten their lives ; and as it is thought that such disease is always indicated by the condition of the lungs, the utmost care is taken by the searcher or *bodek* in the examination of these organs. His rules or instructions for this purpose are very strict; but generally it may be said that he condemns as unlawful, or unfit for food, the flesh of all animals in which the lungs present the following appearances :—Certain deficiencies, excess, or displacement of the lobes; adhesions, or false membranes; tubercles, or abcesses containing matter or opaque water; discolourations which do not disappear when the lungs are inflated; ulcers, holes, and abrasions letting air through them; consolidations that are impervious to air, and rottenness of tissue. Many of these are, no doubt, unimportant evidences of disease, and, therefore, although the flesh of such animals is rejected by the Jew, it is freely consumed by the Christian. The Jews, indeed, make a sort of bargain with the unorthodox butcher, to take only such animals, when slaughtered by their officer, the bodek, as he considers lawful, and the rest are sold to the public. I dare say this has been the practice at all times, for there are frequent references to it in our legal and domestic records. In *Liber albus*, for example, there is a memorandum to the effect that on the 24th of June, 1274, certain discreet men of the city were summoned before the king's council, to answer the question as to what was done with the unclean flesh of the Jews, and whether it was lawful for Christians to buy and eat the same. Their answer was, that if any citizen bought such flesh of a Jew, he would be expelled, and if convicted by the sheriff he would forfeit such flesh, which would be given to lepers or dogs, and he, in addition, would be heavily fined. To which the council replied that they commanded them in the king's name, to have the custom strictly observed. I fear, however, from the legal records of *Liber albus*, that less attention was paid in those days to the sale of diseased meat than to that of putrid meat; for, on examining the accounts of the citizens made and rendered in divers courts of the king, I find that while "judgment of pillory" is recorded in twenty-one cases for selling putrid meat, poultry, or fish, there is not a single instance of a like punishment for selling the unclean meat of the Jews.

In ancient Rome there were overseers appointed to examine the meat in the public markets before it was sold, and butchers were often fined for neglecting the law in this respect. Mr. Charles Reed has given us an example of this from the *Acta Diurna*, or Roman Gazette of 585 years after the building of Rome, which when translated, runs thus:—A. U. C. DLXXXV. Fourth of the kalends of April. The fasces, with Licinius, the consul, and Lertinus, ædile, fined the butchers for selling meat which had not been inspected by the overseers of the markets. The fine is to be employed towards building a chapel to the temple of the goddess Tellus.

In modern times, also, severe regulations have been made in all the States of Europe for the government of this matter, and in many cases particular instructions are given as to the kind of disease which renders meat unfit for human food—it being the practice to examine the animal while alive, and its carcass when dead. This examination is entrusted to properly-qualified officers, who are bound to condemn diseased and putrid meat, as well as the flesh of animals that have died otherwise than by the hand of the butcher; and no meat can be sold until it has undergone such an examination. In this country, however, although there are laws prohibiting the sale of unsound and unwholesome food, yet there is no provision for the systematic inspection of meat, even when it has reached the public shambles. All that the law declares is, that the local authority may, if it pleases, appoint an officer for that purpose; and as the appointment would cost money, and is not compulsory, it is rarely made. Practically, therefore, there is, except in a few places, an almost unchecked traffic in diseased and unwholesome meat; and the worst descriptions of it are generally sold to the poor at night.

Our forefathers made stringent rules to prevent this; for, among other things, they ordained "that butchers shall close their shops before candle-light, and shall not sell flesh meat by light of candle."—(*Liber albus.*)

Within the city of London the inspection is performed as carefully as it can be, but, nevertheless, amidst the confusion of business in the early hours of morning, a great deal of unsound meat escapes the notice of the inspectors. In fact, if it were not for the assistance afforded to them by the salesmen of the markets, it would be absolutely impossible to check, to any large extent, the sale of unwholesome meat; for, in the three markets of the city—Newgate, Aldgate, and Leadenhall, as much as 400 tons of meat are sold daily. It is brought from all parts of Great Britain and Ireland, as well as from Belgium, Holland, and France, and even from the ports of the Baltic. Of this, a large quantity is diseased, and it comes chiefly from our own country towns, where it is a common practice to forward to London everything that is unsaleable at home. I cannot tell what is the actual proportion of bad meat to good, but we seize and condemn about two tons a week, and this is in the proportion of one part to 750. Last year the amount of meat condemned as unfit for food was nearly 129 tons, and in the preceding year it was more than 152 tons. In fact, during the seven years which have expired since the inspectors were appointed under my recommendation, we have seized and destroyed 1,567,810 lbs., or just 700 tons of meat as unfit for human food. Of this quantity, 805,653 lbs. were diseased, 568,375 lbs. were putrid, and 193,782 lbs. were from animals that had not been slaughtered, but had died from accident or disease. It consisted of 6,640 sheep and lambs, 1,025 calves, 2,896 pigs, 9,104 quarters of beef, and 21,976 joints of meat; besides which, there were also seized and condemned in the city markets on account of putridity, 19,040 head of game and poultry, 207 quarters of venison, and above seven millions of fish, together with thousands of bushels of whelks, shrimps, periwinkles, &c.

It is to be regretted that in the various Acts of Parliament which relate to the condemnation of unsound meat, there are no special rules for the guidance of the officers appointed to investigate this matter—there being only a very loosely-worded general provision to the effect that the medical officer of health, or the inspector of slaughter-houses, or the inspector of nuisances, may, at all reasonable times, inspect and examine any animal, carcass, meat, poultry, game, flesh, fish, &c., exposed for sale, or deposited in any place for the purpose of sale, or in preparation for sale, or intended for the food of man; and in case it appears to the medical officer of health, or the inspector, to be diseased, or unsound, or unwholesome, or unfit for the food of man, it shall be lawful for him to seize the same, and for a justice to order it to be destroyed. In this regulation there is no particular reference to the kind of food which is unwholesome, or to the circumstances which render it so, and, therefore, much is left to the discretion of the officer who examines it. In the city of London the practice is to condemn the flesh of animals infected with certain parasites, as measles, flukes, &c.; and of animals suffering from fever or acute inflammatory affections, as rinderpest, pleuro-pneumonia, and the fever of parturition, and of animals emaciated by lingering disease, and those which have died from accident or from natural causes, as well as all meat tainted with physic, or in a high state of putrefaction. A little practice is required to distinguish meat of this description, but, generally, it may be said that good meat has the following characters:—

1st. It is neither of a pale pink colour nor of a deep purple tint, for the former is a sign of disease, and the latter indicates that the animal has not been slaughtered, but has died with the blood in it, or has suffered from acute fever.

2nd. It has a marbled appearance from the ramifications of little veins of fat among the muscles.

3rd. It should be firm and elastic to the touch, and should scarcely moisten the fingers—bad meat being wet, and sodden, and flabby, with the fat looking like jelly or wet parchment.

4th. It should have little or no odour, and the odour should not be disagreeable, for diseased meat has a sickly cadaverous smell, and sometimes a smell of physic. This is very discoverable when the meat is chopped up and drenched with warm water.

5th. It should not shrink or waste much in cooking.

6th. It should not run to water or became very wet on standing for a day or so, but should, on the contrary, dry upon the surface.

7th. When dried at a temperature of 212° or thereabout, it should not lose more than from 70 to 74 per cent. of its weight, whereas bad meat will often lose as much as 80 per cent.

Other properties of a more refined character will also serve for the recognition of bad meat, as that the juice of the flesh is alkaline or neutral to test-paper, instead of being distinctly acid; and the muscular fibre when examined under the microscope is found to be sodden, and ill-defined.

The signs of parasitic diseases are not always observable without careful examination. In the case of the fluke in the livers of sheep, and of measles in pork, and of hydatids in the brain or liver, the nature of the disease is at once discoverable, but it is not so with the smaller measles or cysticerci of beef and veal, and it is still less so with the trichina of pork—the microscope being required to reveal their presence.

And here, perhaps, we may ask, *what are the effects of* *diseased or putrid meat on the human system?* The question is undoubtedly very difficult to answer, for while, on the one hand, we have abundant evidence that such meat may frequently be eaten with impunity, so on the other we have many remarkable instances of injury occasioned by it. In Scotland there is a disease called *braxy*, which attacks the sheep and lambs in spring and early summer. It is the cause of at least half the deaths in the flock during the year. The disease kills the animals very quickly by causing stagnation of blood in the most important vital organs; and as the carcass is the perquisite of the herdsman, he most invariably eats it—taking the precaution to remove the offal, and to cut away the darker portions of the flesh where the blood has stagnated. He also salts it before he uses it; and if questioned on the subject he will tell you that the meat is not unwholesome. Every now and then, however, when perhaps the diseased parts have not been entirely removed, or when the salting has not been sufficiently prolonged, or the cooking has not been thoroughly effected, the most serious consequences result from it, insomuch that many medical practitioners who are acquainted with the habits of the Scotch shepherds in this respect, and have seen the mischief occasioned by the meat, declare that braxy mutton is a highly dangerous food for man. Again, it is a common practice with farm-labourers to eat the flesh of sheep affected with staggers, which is a parasitic disease of the brain; and even of animals dying from acute inflammatory diseases. There is a story told on the authority of Dr. Brücke, the professor of physiology in Vienna, that some years ago, when the *steppe-murrain* was prevalent in Bohemia, and the infected animals were killed and buried by order of the government, the poor people dug up the carcasses of the dead bullocks, and cooked them, and ate them, without injury. In this country also, during the prevalence of *rinderpest* in 1863, enormous quantities of meat from the diseased animals were sent to market, and sold and eaten. The same has been the case with the carcasses of animals suffering acute *pleuro-pneumonia;* and if, as Professor Gamgee says, the practice of making salvage out of diseased animals is so common, that at least one-fifth of the meat which is sold in the public markets is diseased, we may well ask, in the words of Mr. Simon, how it is that some sort of pestilence is not bearing witness to the fact? How it is that cattle having all the foulness of fever in their blood, or having local sores and infiltrations, that yield one of the deadliest of inoculable morbid poisons, or having their flesh thronged with larval parasites, do not when slaughtered and eaten produce a general poisoning? Parent Du Chatelet has commented in very forcible language on the apparent immunity from disease even when the most foul and loathsome of animal foods are eaten. But is it not possible that the danger is averted by the operation of cooking? Not that the human stomach has not also a wonderful protective power in its own natural functions; for the deadly poison of the cobra or the rattle-snake may be swallowed with impunity. It is possible, however, that these safeguards may fail us occasionally, and then it is perhaps that the most serious consequences arise. I have often had to investigate cases of mysterious disease which had undoubtedly been caused by unsound meat. One of these, of more than ordinary interest, occurred in the month of November, 1860. The history of it is this: a fore-quarter of cow-beef was purchased in Newgate Market by a sausage-maker who lived at Kingsland, and who immediately converted it into sausage meat. Sixty-six persons were known to have eaten of that meat, and sixty-four of them were attacked with sickness, diarrhœa, and great prostration of vital powers. One of them died; and at the request of the coroner, I made a searching inquiry into the matter, and I ascertained that the meat was diseased, and that it, and it alone, had been the cause of all the mischief. Dr. Livingstone tells us that when the flesh of animals affected with pleuro-pneumonia is eaten in South Africa, by either natives or Europeans, it invariably produces malignant carbuncle. He says, indeed, that the effects of the poison were often experienced by the missionaries who had eaten the meat, even when the presence of the disease was scarcely perceptible; and in many cases when the Backwains persisted in devouring the flesh of such diseased animals, death was the consequence. The virus, he says, is neither destroyed by boiling nor by roasting, and of this fact he had innumerable instances. Now, it is a remarkable circumstance that ever since the importation of this disease (pleuro-pneumonia) into England from Holland in 1842, the annual number of deaths from carbuncle, phlegmon, and boils, has been gradually increasing. In the five years preceding that time the mortality in England from carbuncle was scarcely 1 in 10,000 of the deaths; from 1842 to 1846 there is no record of the disease; but in the next five years, from 1846 to 1851, the mortality rose to 2·6 per 10,000 of the deaths; and in the next five years it amounted to 6·2 per 10,000; and in the succeeding five years to 5·4. In the case of phlegmons, the increase in the mortality is still more remarkable, for it rose from an average of 2·5 per 10,000 of the deaths in the five years preceding the importation of the disease, to 81 per 10,000 in the ten years from 1847 to 1856. The Registrar-General of Scotland has directed public attention to this fact, saying that deaths from carbuncle are on the increase, and that the mortality from it has been getting larger and larger ever since the lung disease of cattle was imported into Scotland. This accords with the experience of medical practice; but as it is very difficult to trace the immediate connection of bad food with subsequent disease, there being so many circumstances to weaken the connection, it is not surprising that differences of opinion should exist as to the morbific effects of unsound meat; nothing, in short, but an experimental inquiry into the subject, as has already been done in Germany in the case of parasitic diseases, will bring the question to rest; and I see no reason why such an investigation should not be made on the persons of those who send diseased meat to the public market for sale; for, as the common defence of their conduct is, that the meat is good for food, they cannot surely object to the penalty of being made to eat it. Here, for example, is a specimen of pork covered with pustules of small-pox; it was seized by one of the City officers on the road to a notorious sausage-maker, and it may, notwithstanding its disgusting appearance, be good and wholesome food; then why not put the question to the proof by making the vendor of it eat it? In the year 1862, when small-pox was prevalent among the sheep in several parts of England it was a common practice to send the carcasses of diseased animals to the London markets for sale as human food. Later still, in 1863, there was an epidemic of what seemed to be scarlet fever among the pigs of this metropolis, and their carcasses, with all the bright crimson look of the disease, were invariably sent to market for salt as food. Since then the London pigs have been the subject of a virulent spotted fever, of the nature of typhus, and these also have been killed in the last stage of the disease, and sold for food. Abundant illustrations of this kind are constantly coming under my notice; and I feel that the question of the fitness of such meat for food is in such an unsettled state that my action in the matter is often very uncertain, and I should like to have the question experimentally determined; for, as it now stands, we are either condemning large quantities of meat which may be eaten with safety, and are, therefore, confiscating property, and lessening the supply of food, or we are permitting unwholesome meat to pass almost unchallenged in the public markets.

As regards the injurious quality of meat infected with parasitic disease there can, however, be no question; and, perhaps, of all such infections, the most terrible is the *trichina* of pork. Fortunately, it is a rare affection in this country, although it is often common in Germany. The pork infected with the worm is generally darker than usual, on account of the irritating or inflammatory action of the creature lodged in the muscles; and when the parasite is encysted the meat presents a speckled appearance—the minute white cysts containing the worm being just visible to the naked eye. Here are specimens of it in both its encysted and non-encysted conditions; and this diagram represents the appearance of the worm when it is examined under the microscope. It is, as you see, a minute thread-like worm, about the thirtieth of an inch in length, coiled up in a spiral form; hence its name, *trichina spiralis*. It is generally found in the human subject in an encysted state, when it has passed beyond its dangerous condition, and has become harmless. In most cases, when thus discovered, there is no record of its action, and therefore it was once thought to be an innocent visitor; but we now know that while it was free—that is before nature had barricaded it up in the little cyst, its presence was the cause of frightful disorder—killing about 50 per cent. of its victims in terrible agony. In Germany, there have been frequent outbreaks of the disease, which, for a time, baffled the skill of the most experienced physicians; in fact, we hardly know how long or how often the disease has attacked the pork-feeding population of Europe, for its actual nature was unknown until the year 1860, when Dr. Zencker, of Dresden, discovered the pathology of the disease. Since then there have been several visitations of it, as at Plauen, in Saxony, in 1862; at Hettstadt, near Eisleben, in 1863; and at Hedersleben, near Magdeburg, in Prussian Saxony, in 1866. In all these cases the same symptoms, or nearly the same, were observed; there was sometimes immediate disturbance of the digestive functions, but more commonly a day or two elapsed before any particular symptom was noticed, and then there was a feeling of lassitude, with a loss of appetite, and pains in the head and back. Then followed a serious disturbance of the alimentary canal, with vomiting and diarrhœa. This lasted for a day or two; and by the end of a week after the worm had been eaten fever had set in, which became more and more severe, and by that time the young worms which had been hatched in the body had migrated to the distant muscles, causing the most excruciating pains, so that the patient, fearing to move his inflamed muscles, would lie motionless upon his back; and if he did not die in this state of the disorder nature came to the rescue, and imprisoned the creature by surrounding it with a fibrinous cyst, where it lives for years, being ready at any moment to acquire activity when it is swallowed and released from its cell. Indeed, the way in which it becomes dangerous is this —flesh infected with the parasite is eaten; and the cyst being quickly dissolved by the gastric juice, the creature is set free. Finding itself in the midst of nourishing food it rapidly grows, so that in two or three days it is three or four times its original size, and may be easily seen, like a bit of fine thread, with the naked eye. The worms are of different sexes, and they rapidly come to maturity—each female giving birth to from 300 to 500 minute thread-like worms, which immediately set out upon their travels, piercing the walls of the intestines and migrating to distant parts of the body, where they produce the terrible mischief I have described. Although the pig is the animal which is most commonly infested by it, yet it has been found in the muscles of dogs, foxes, badgers, sheep, moles, hedgehogs, rats, mice, frogs, and most carnivorous birds, all of which must have been subjects of the disease, but none appear to suffer from it like man; even children are less affected by it, for they seem to sleep it away. Fortunately, there is an easy method of discovering its presence in animals, for the most certain seat of the creature is in the muscles of the eye; we have therefore only to examine these muscles with the microscope to declare whether the meat is infected or not; and, at the present time, the saussage-makers of Germany have the pork examined in this manner before it is used for food.

Other parasitic creatures, as *measles* in pork, and the smaller *cysticerci* of beef and veal, are found as little sacs or bladders diffused through the lean of the meat—the *cysticercus* or *measle* of pork being easily seen, for it is as large as a hemp-seed. Here are specimens of it in a fresh condition, which were seized in the City markets to-day; but the cysticercus of other animals is much smaller, and requires careful exploration to discover it. In both cases the sac contains a little creature with a sort of tuberculated head, crowned with a coronet of hooks, and having a bladder-like tail attached to it. Soon after it is swallowed, the enclosing sac is dissolved by the gastric juice, and the creature being liberated passes into the intestines, and there fixes itself by its little hooks, and quickly grows, joint after joint, into a tape-worm. In the case of the cysticercus of pork, it forms the variety of tape-worm called *tenia solium*, and in that of beef and veal it produces the *tenia mediocanellata*. The latter is the most common variety of it in the human intestines, and it is frequently seen where raw, or nearly raw, meat is made use of, as in Abyssinia and in Russia, where children are allowed to suck a piece of raw beef, on the supposition that it has a strengthening property. Each segment of the worm is an independent creature, containing myriads of ova, and when passed by the bowels, it gets with the manure upon the land and is eaten by pigs, oxen, and goats; the ova are then hatched in the stomach, and they pass, as in the case of the trichinia, through the walls of the intestine, and migrate to the muscular tissues of the body, where they become encysted, and form the little sacs or measles, which remain dormant for years, though they are ever ready to become tape-worms directly they are eaten. In this manner the creature is perpetuated, first as a tape-worm, with joints in the intestines of one animal, and then as a measle or larva in the muscle of another, and then again as a tape-worm. By a like process the *tenia chinococcus*, or little tape-worm of the dog, becomes the *hydatid* in man and other animals. In Iceland the dogs are very liable to this infection, and the cattle and sheep, as well as man, suffer from the hydatid of it. The subject has been well investigated by Dr. Leared, who has shown that the practice of giving the diseased offal of the slaughtered animals to dogs, causes tape-worm, and the dogs drop the segments of the worm, filled with ova, upon the pastures and into running water. By this means they enter the bodies of cattle and sheep, and even of man, and then, as in the last case, the ova quickly become developed, and the young hydatid or larva tape-worm, piercing the walls of the alimentary canal, migrates to distant parts, and finding a suitable nidus for its growth, it slowly becomes a large bladder-like *hydatid*. In the case of the sheep it often selects the brain for its habitat, and produces the disease called *staggers*; in the oxen it grows in the peritoneal cavity; and in man it haunts the liver, occasioning frightful disturbance of the system, and causing one-sixth of the total mortality of that country. Here are specimens of the disease from the human subject.

Again, there is another class of parasite called *trematoda*, or *flukes*, which infest the livers and intestines of men and herbivorous animals. The most common of them is the *distoma hepaticum* or *liver-fluke* of the sheep. In wet seasons the animal is so constantly infested with them, and suffers so much emaciation from them, that the disease is called the rot. You have before you infected livers which were seized in our public markets this very day, and there is no difficulty in obtaining specimens of them at almost any time. A few years ago (1863), when Professor Brown was lecturing on the liability of animals to disease from the present mode of feeding them, he said that once, when he wanted some animals for dissection, and applied for them to a large butcher, he received back five or six animals, which, though in a bad state of rot, were dressed for the market; and he was told by a certain individual not far from

London, that within the space of six months he had killed no less than 750 of such animals, in a state of extreme disease, and he believed they were all sent to market and sold for food. What becomes, he says, of the hundreds and thousands of rotten sheep which we see in the fields? To bury them would require whole catacombs; the real catacombs are the intestinal canals of the human body. The way in which the disease is produced in sheep is curious. Ova are passed from the gall-bladder of infected animals into the intestines, and so upon the land; finding a moist situation they are soon hatched into ciliated embryos, which swim about and become developed into cylindrical sacs of minute hydatids; these attach themselves to some mollusc, as a small snail. In wet weather the infected snails crawl upon the grass, and are eaten by the sheep, and then the hydatid speedily changes his condition and becomes a fluke. When it is found in the body of man it has, perhaps, been drunk with water or eaten with some aquatic plant, as water-cress, &c.

Our safety against these intruders is to cook the meat thoroughly.

The flesh of animals that have been excited before death, as by over-driving, or by torture, has frequently proved unwholesome. A remarkable instance of this is quoted by Liebig, in his Letters on Chemistry, where a family of five persons were made seriously ill by the flesh of a roebuck which had been caught in a snare, and had struggled violently before death.

It is, moreover, a curious fact, that meat may be even poisonous from the nature of the food made use of by animals shortly before they are killed; and this, too, without any indication of disorder in the animals themselves. Hares which have fed upon the *Rhododendron chrysanthemum* are frequently poisonous; the same is the case with pheasants in Pennsylvania and Philadelphia, which feed during the winter and spring on the buds of the laurel (*Calmia latifolia*); and I have known many instances of serious mischief from prairie birds, which are now largely imported into this country from America, and I attribute it to the food made use of by the bird. In certain districts of North America, especially on the Alleghany mountains, the flesh of all the cattle is poisonous, and so also is the milk they yield, and the cheese which is made from it. Oysters, mussels, lobsters, and crabs have frequently caused disturbance of the human system; and the probability is that they were made unwholesome by the food which they had eaten. A singular case is recorded in the medical journals of France in 1842, where a whole family at Toulouse were poisoned by a dish of snails, the animals having been gathered from a poisonous shrub (*Coriaria myrtifolia*); and it is not at all uncommon for honey to be unwholesome, on account of its having been collected by bees from poisonous plants. The honey of Trebizond, for example, has long been notorious for its deleterious properties; it poisoned the soldiers of Xenophon during the famous retreat of the ten thousand. Pliny, too, speaks of it; and to this day its intoxicating effect is frequently witnessed. It arises, no doubt, from the plants, chiefly the *Azalea pontica*, from which the honey is gathered. Mr. Barton has given us a similar account of the poisonous quality of the honey gathered by bees from the savannahs of New Jersey, where the *calmia* and *azalea* are the principal flowering shrubs. As with the followers of Xenophon, all who eat of the honey become intoxicated to a high degree; and even when made into metheglin, it poisons all who partake of it, causing dimness of sight, giddiness and then delirium, with sometimes a fatal termination.

Occasionally we have examples of food which is in itself poisonous. This is so with many of the fish of tropical seas, and especially of the West Indies. Dr. Burrows has given us a long list of them; and it would seem that the yellow-billed sprat (the Sardine doré of the French, and *Clupea thryssa* of naturalists), the toad or bladder-fish (*Aplodactylus punctatus* or *Tetraodon* of Cuvier) and the grey-snapper (*Coracinus fuscus major*) are the most venomous; and that being eaten by larger fish, as the *Baracosta*, and various species of perch, as well as the conger-eel, the dolphin, the globe fish, &c., it causes these to be poisonous also. The yellow-billed sprat is so virulent in its action on the human body that both Europeans and negroes have been known to expire with the fish in their mouths unswallowed; and the toad or bladder-fish, is scarcely less dangerous. Sir John Richardson has described the defects of it on two sailors, the boatswain's mate and purser's steward, of the Dutch brig of war, *Postilion*, while lying at anchor in St. Simon's Bay, at the Cape of Good Hope, in September, 1845. The men were warned that the fish was poisonous, but believing that the liver was wholesome, and rather a delicacy, they cooked it, and ate it directly after their twelve o'clock dinner. In ten minutes the boatswain's mate was so ill that he could not stand; his face was flushed, his eyes glistened, his lips were swollen and rather blue, his forehead was covered with a cold perspiration, and his pulse was weak and fluttering. He was, however, quite conscious, and complained of pain and constriction of the throat, and he had a desire to vomit. In a few minutes more he became paralysed, his eyes were fixed, his breathing was laborious, his face was pale though his lips were livid, and in seventeen minutes he was dead. The other man exhibited the same symptoms, and died in twenty minutes. Sir John Richardson says, the fish was not more than six or eight inches in length, and the liver of it, which they had eaten between them, could not have weighed more than half an ounce.

The symptoms occasioned by the poisonous fish of the tropics are always of two kinds—there is either great irritation of the stomach and bowels, like cholera; or there is rapid prostration of the vital powers, and death by syncope or convulsions. These effects have been long known both to natives and Europeans, and were called by the Spanish colonists of tropical America, *Siquatera*. They are more frequently observed at certain seasons of the year than at others, and hence they are thought to be due to certain physiological changes in the body of the fish, or to the food which it has eaten. In some cases the roe, in others the liver, or the digestive organs, are the most poisonous parts of the fish; and in the case of the *Maletta venenosa*, which inhabits the Caribbean Sea, it is only poisonous when the sea is covered with a green monad, upon which the creature feeds. Happily for us, these dangers are confined to the tropics, although we sometimes suffer from a milder form of disturbance, as irritation of the skin and bowels, from eating unwholesome shell-fish.

Putrid meat is, perhaps, wasteful, rather than actually injurious; but there are plenty of cases in which it has caused disease. Foderé tells us that at the seige of Mantua, those who were shut up in the city, and were obliged to eat the half-putrid flesh of horses, suffered from gangrene and scurvy; and in Czant's history of Greenland there is an account of the death of thirty-two persons at a missionary station called Kangek, from a repast on the putrid brains of a walrus. Similar cases are recorded in all the books on legal medicine. Even game, when only sufficiently tainted to please the palate of the epicure, has caused severe cholera in persons unaccustomed to it; but, as Dr. Christison observes, "the power of habit in reconciling the stomach to the digestion of decayed meat is inconceivable. Some epicures in civilised countries prefer a slight taint even in their beef and mutton; and there are tribes of savages still further advanced in the cultivation of this department of gastronomy, who eat with impunity rancid oil, putrid blubber, and stinking offal." The Zulus of Natal, according to Dr. Colenso, are so fond of putrid meat that they call it *ubomi*, which literally means to be superlatively happy. But, as a rule, there is a natural abhorrence of tainted food, insomuch, that with most persons, the mere commencement of decay is sufficient to excite disgust; and rarely do we find, except among savages, that an entire meal is made of putrid flesh. A little game or venison, or ripe cheese, at the end of a feast, with just a piquant touch of decay, is, perhaps, not objectionable; for it may, as Liebig supposes, promote digestion, by communicating its own quality of transformation to the rest of the food; but it is another thing to fill the stomach with putrid flesh, for if the corrective power of the gastric juice should fail, the effect of it might be serious. We have, indeed, abundant evidence of the terrible consequences of admitting putrid matter into the circulation, for they were once too common among those engaged in the dissection of the human body. In fact, the mere handling of decomposing animal matter for any time, will often produce disease of the hands or other parts of the body with which it comes into contact. Our safety, perhaps, in using such food, is in the antiseptic power of good cooking; but this is not always an easy affair; for the tissues are generally so soft from decay, that they will hardly bear the common action of heat; so that if they be boiled for any time they will fall to pieces; and if they be roasted, they will shrink without forming that delicious crust of osmazome which is characteristic of good meat. Let them, however, be cooked as they may, they always require a nice adjustment of rather strong flavours to make them palatable; and those who have dined in the cheap restaurants of Paris, or at the still worse table d'hôte of a German watering-place, will have experienced the art of the cook in this respect, in such dishes as *turbot en vol-au-vent*, *Raie au beurre noir*, *sole en matelote Normande*, and in the various forms of fish *au gratin;* or game *en salmis*.

But bad as this sort of tainted food is, it is nothing in comparison to the sausage poison, which is produced by a sort of modified putrefaction, to which the large sausages of Germany, and especially those of Würtemburg, are occasionally subject. According to an official return, there have been more than 400 cases of poisoning from these sausages in Würtemburg alone during the last fifty years, and of these about 150 were fatal. The effects are generally observed in spring, and mostly in April, when the sausages become musty, and acquire a soft consistence in the interior. They have also a peculiarly nauseous and rather putrid taste, and are very acid to test-paper. If eaten in this condition, they produce dangerous effects in from twelve to twenty-four hours—the first symptoms being pain in the stomach, with vomiting and diarrhœa, and dryness of the nose and mouth; then comes a feeling of profound depression, with coldness of the limbs, weakness and irregularity of the pulse, and frequent fainting. Fatal cases end with convulsions and oppressed breathing between the third and eighth day. The precise cause of these effects is still a mystery; some have thought that rancid fatty acids are produced during the decomposition of the meat; others that in the process of drying and smoking acrid pyrogenous acids have been developed; others, that during the decay of the sausages, a poisonous organic alkaloid is generated. Liebig is of opinion that the effects are due to an animal ferment, which produces in the blood, by catalysis, a state of putridity analogous to its own, and that the molecular movements of the putrefactive change in the decaying meat are thus communicated to the living organism. M. Vanden Corput, who is one of the most recent investigators of the subject, attributes the morbific action of such meat to the presence of a minute fungus, of the nature of a sarcina, which he calls *sarcina botulina*. This view is confirmed by the fact that there is always a peculiar mouldiness of the sausages; and the poisonous property is generally observed in April, when these cryptogamic organisms are most freely developed.

Similar effects have occasionally been produced by other kinds of animal food—as veal, bacon, ham, salt-beef, salt-fish, cheese, &c., and the food has usually been in a decayed and mouldy condition. It would be tedious if I were to detail, or even to enumerate the cases recorded by medico-legal writers; but I may, perhaps, refer to a few of them. In 1839, there was a popular fête at Zurich, and about 600 persons partook of a repast of cold roast veal and ham. In a few hours most of them were suffering from pain in the stomach, with vomiting and diarrhœa; and before a week had elapsed, nearly all of them were seriously ill in bed. They complained of shivering, giddiness, headache, and burning fever. In a few cases there was delirium; and when they terminated fatally, there was extreme prostration of the vital powers. Careful inquiry was instituted into the matter, and the only discoverable cause of the mischief was incipient putrefaction and slight mouldiness of the meat. Dr. Geiseler relates an instance where a family of eight persons were made ill by musty bacon; and M. Ollivier has given an account of six persons who were poisoned by mutton in a state of modified decay—four of whom died from it within eight days. In Russia, where it is the practice to eat largely of salt-fish, in a raw condition, it is not at all uncommon to witness the dangerous effects of it, when it has become mouldy or putrid; and, in fact, it is within the experience of every one who is concerned in medico-legal inquiries, that serious symptoms are frequently traced to the use of food in a modified condition of decay. This is especially so with bad cheese, the effects of which on the constitution have been so severe, that official investigations have been called for. These effects have been noticed at Schwerin (1823), at Minden (1825), at Hameln (1826), at Griefswald (1827), Frankfort (1828), and elsewhere; and they have been the subjects of interesting essays by Henneman, Hünefeld, Westrumb, and others. At first the effects were attributed to the copper vessels used in the dairies, and therefore the Austrian, Wirtemberg, and Ratesberg States prohibited the use of that metal for such purposes; but the subsequent inquiries of Hünefeld, Sertürner, and other chemists, established the fact that no metallic poison was discoverable in the cheese. In the police report, which was published in Frankfort, in January, 1828, informing the public of numerous cases of poisoning in that city from spoiled cheese, it was declared that no poisonous principle could be detected by chemical re-agents. Professor Hünefeld, and, subsequently, Sertürner, were of opinion that the effects were due to certain poisonous fatty acids, analogous to, if not identical with, caseic and sebacic acids; and they even describe the way in which they are produced in the cheese during the process of ripening—attributing them to the imperfect removal of the acid liquor from the curd when the cheese was made, or to the putrefaction of the curd before it was salted, or to the mixture of flour with the curd; but it is far more likely that the poisonous effects are due, as Vanden Corput supposes, to the presence of a peculiar mould or fungus. I have myself seen the most terrible consequences from the use of such cheese. and have failed to discover anything unusual in the acidity or other chemical reactions of the cheese. Hünefeld says, it is commonly of a yellowish-red colour, and is soft and tough, with harder and darker lumps interspersed throughout it, and it has a disagreeable taste, and an acid reaction. The symptoms which it produces are very much like those of sausage poisoning—namely, irritation of the stomach and bowels, with great prostration of the vital powers. These effects have been witnessed not only in Germany, where the cheese is generally rancid and bad, but also in this country, and particularly among the small hill-farms of Cheshire, where the limited extent of the dairies obliges the farmer to keep the curd for several days before a sufficient quantity of it is accumulated to make a large cheese.

I have said nothing of the improper practice of killing very young animals, especially calves, for food, before the tissues have had time to change from their uterine condition. On the Continent it is unlawful to kill or to sell calves for food, that are not more than fourteen days old, but in this country there is no such restriction, and it is a common practice to dispose of the carcasses of newly-born, or even fœtal calves to the sausage-maker; and as the flesh is sodden and insipid, he strengthens it with old, tough, and sinewy flesh. It has the advantage, moreover, of being miscible with any description of meat, and of taking any variety of flavour; in fact, it makes just that kind of sausage which is susceptible of any kind of flavour, and where, to use the expression of Dickens, "It's the seasonen as does it." I cannot say that such meat is positively unwholesome, but it is nasty, and excites the same sort of disgust as an egg with a chick in it.

(*To be continued.*)

Proceedings of Institutions.

Yorkshire Union of Mechanics' Institutes.—*Otley Mechanics' Institute.*—The building committee have selected a design for the new institute. About nineteen different designs were submitted for competition by architects from Leeds, Bradford, and other places. The committee, in their selection, have been guided principally by the amount of money at their disposal. The subscriptions already promised amount to over £3,000, and the committee are most anxious that the new building, when erected, shall be free from debt. Their object, therefore, has been to select a plan which would afford the greatest possible accommodation for the least expenditure. The design is Italian, and the following are the chief features of the internal arrangements:—On the ground-floor there will be a small lecture-room, capable of accommodating about 250 persons, and which, if found desirable, may be divided into two class-rooms. There will also be retiring rooms, reading-room, library, two class-rooms, lavatory, &c. The basement will contain kitchen, scullery, chemical class-room, heating apparatus, &c. On the first-floor will be the large hall, with gallery, platform, orchestra, and space for organ. There will also be a librarian's residence attached to the premises. The large hall, including gallery and orchestra, will be capable of seating about 1,000 persons. There will be two staircases, and three separate entrances and exits into and from the large lecture-hall. The building is to be built of stone, at an estimated cost of about £3,000. *Gargrave Mechanics' Institute.*—Through the organising agency of the Yorkshire Union, and by means of the pecuniary aid readily given by Mr. Matthew Wilson, J.P., and other resident landowners, a new Mechanics' Institute has been established in this village. A convenient house has been taken, and suitably adapted to the purposes of an institute. The village has been canvassed for members, with excellent results. The library will, at first, consist of a loan of books from the Yorkshire Itinerating Village Library, but a special subscription is being made for a permanent library. Should the present arrangements produce satisfactory results, Mr. Wilson has generously promised to erect a new building for the institute. *Lockwood Mechanics' Institute.*—A fine art, scientific, and industrial exhibition has been inaugurated at Lockwood. The proceeds are to be given to the funds of the new Mechanics' Institution. Paintings by well-known masters have been contributed, and, as far as the fine art collection is concerned, it is said to be the best exhibition ever witnessed in the neighbourhood of Huddersfield. There are specimens of natural history, geology, and antiquity; and there are numerous subjects and objects to occupy the attention of the collectors of coins and other curious articles. The Rev. T. B. Benstead, vicar of Lockwood, opened the exhibition, and said the object which the committee had in view was to increase their funds, and, at the same time, refine the tastes of those by whom they were surrounded. A band played during the afternoon. The exhibition is to remain open about a fortnight. *Gildersome Literary Institute.*—On Saturday the annual *soirée* of this institution was held, under the presidency of the Rev. J. Haslam, its founder. Amongst the gentlemen on the platform were Mr. Alfred Illingworth and Mr. Cooke, of Bradford; Mr. Councillor Barran, Leeds; Mr. George Webster, Gildersome. The report stated that at the beginning of the year arrangements were made for classes every night in the week. Several of these had been successful, but others had failed, owing to the difficulty of securing regular voluntary teachers; and the committee felt that if the teaching of elementary subjects was to succeed, a paid teacher must be engaged. The certificates and prizes awarded by the Yorkshire Board of Education were presented to the successful candidates.

EXAMINATION PAPERS, 1868.

(*Continued from page 751.*)

The following are the Examination Papers set in the various subjects at the Final Examination held in April last:—

ENGLISH LITERATURE.

THREE HOURS ALLOWED FOR THE TWO AUTHORS SELECTED BY THE CANDIDATE.

Chaucer.

(The Prologue.—The Knight's Tale.)

(*a.*) Lo the ook, that hath so long norisschyng
Fro tyme that it gynneth first to spring,
And hath so long a lyf, as we may see,
Yet atte laste wasted is the tree.

(*b.*) Thus ryt this duk, thus ryt this conquerour,
And in his oost of chevalrie the flour,
Till that he came to Thebes, and alighte
Fair in a feeld wher as he thoughte to fighte.

(*c.*) And sikurly sche was of gret disport,
And ful plesant, and amyable of port,
And peyned hire to counterfete cheere
Of court, and ben estatlich of manere,
And to ben holden digne of reverence.

(*d.*) The busy larke, messager of day,
Salueth in hire song the morwe gray;
And firy Phebus ryseth up so bright,
That al the orient laugheth of the light,
And with his stremes dryeth in the greves
The silver dropes, hongyng on the leeves.

(*e.*) To lyven in delite was al his wone,
For he was Epicurius owne sone,
That heeld opynyoun that pleyn delyt
Was verraily felicite perfyt.

(*f.*) For whethur that he payde, or took by taille,
Algate he waytede so in his acate,
That he was ay biforn and in good state.

1. In what connection does each of the above passages occur?—Explain every obsolete word and phrase.—Notice the words that require to be pronounced or accented differently from modern usage to meet the requirements of the verse.

2. What are the most important particulars in which Chaucer's English differs from our own?

3. What do the following words mean?—

orlogge
payen
sothely
howpede
siththen
sege
sawceflem
gery
knarre
takel
undern
stith

II.

4. Sketch the plan of the Canterbury Tales.

5. From what sources did Chaucer get many of the stories?

6. Give some account of the character of pilgrimages in the time of Chaucer.

7. Who were Chaucer's most distinguished contemporaries? Name some of their principal works.

8. On what occasions did Chaucer visit the Continent?

SHAKSPERE.

("King Lear."—"King John."—"The Merchant of Venice.")

I.

(*a.*) A plague upon your epileptic visage!
Smile you my speeches, as I were a fool?
Goose, if I had you upon Sarum-plain,
I'd drive you cackling home to Camelot.

(*b.*) You have too much respect upon the world—
They lose it that do buy it with much care.
Believe me you are marvellously changed.

(*c.*) Take physic, pomp;
Expose thyself to feel what wretches feel;
That thou mayst shake the superflux to them,
And show the heavens more just.

(*d.*) A. James Gurney, wilt thou give us leave awhile?

B. Good leave, good Philip.

A. Philip?—Sparrow!—James,
There's toys abroad; anon I'll tell thee more.

(*e.*) Thou almost makest me waver in my faith,
To hold opinion with Pythagoras,
That souls of animals infuse themselves
Into the trunks of men.

(*f.*) Life is as tedious as a twice-told tale,
Vexing the dull ear of a drowsy man;
And bitter shame hath spoiled the sweet world's taste,
That it yields nought but shame and bitterness.

1. State the connection in which each of the above passages occurs, and the person by whom it is spoken; explain every obscurity of expression or allusion; notice every peculiar grammatical construction.

2. Explain the following words as they are used by Shakspere, and notice any peculiarities in their forms:—

counterfeit
continent
bankrout
wis
schedule
jump
indigest
importance
pight
ghasted
dullard
uncapable.

3. Explain the following passages:—

"How wildly then walks my estate in France!"

"We cannot hold mortality's strong hand."

"Beyond all manner of so much I love you."

II.

4. Sketch the plot of the fourth act of the Merchant of Venice.

5. Describe the character of Shylock.

6. Give an account of the fool in King Lear.

7. From what sources has Shakspere mainly taken the plots of these three plays? Which are the chief particulars in which he has deviated from the facts of history in King John?

8. What do you know of the early editions of Shakspere's plays?

BACON.

(The Essays.)

I.

1. Give the substance of the essay "Of Unity in Religion.

2. How does Bacon prove and illustrate the following statements?—

(*a*) "Revenge is a kind of Wild Justice."

(*b*) "Prosperity is the blessing of the Old Testament: Adversity is the blessing of the New."

(*c*) "Those who are first raised to Nobility are commonly more Virtuous but less Innocent than their Descendants."

3. Explain the following passages, and state from whom they are quoted by Bacon.

"(*a*) "The Schoolmen were like Astronomers, which did feign Eccentricks and Epicycles, and such Engines of Orbs, to save the Phenomena; though they knew there were no such Things."

(*b*) "If it be well weighed, To say that a man lieth, is as much as to say as that he is brave towards God, and a Coward towards Men."

4. Explain the allusions in these passages:—

(*a*) "Nay you shall see a Bold Fellow many times do Mahomet's Miracle."

(*b*) "The part of Epimetheus might well become Prometheus, in the case of Discontentments."

5. Illustrate this statement by historical instances:—

"The Principal Thing that hath been the Destruction of most Plantations hath been the Base and Hasty drawing of Profit in the first Years."

6. Sketch the argument written of the essay "Of Usury," or that "Of Friendship."

7. Explain these words as they are used by Bacon:—

damosell.
conceit.
battaille.
staddles.
civility.
estivation.
proyning.
moile.
defatigation.
scantling.
catchpole.
plash.

II.

8. What do you know of the first publication of Bacon's Essays?

9. Give some account of the *Novum Organon.*

10. Sketch the character of Lord Bacon as an essayist.

CRAIK.

(Outlines of the History of the English Language.)

1. Give some account of the tribes of Gothic race who settled in Britain, and brought with them the language which forms the basis of our present English.

2. What traces are there in our language of a Celtic element?

3. Give instances of names of places which bear witness to the existence of different races amongst the inhabitants of Britain in former times.

4. To what class do those English words chiefly belong which have been taken immediately from the Latin? Give examples.

5. Illustrate, by examples taken from words in common use, the relative positions of the Norman and the Saxon races when the language was in the course of formation.

6. What are some of the most important points of difference between our present English and the Saxon of King Alfred's time?

7. What are the stages of progress into which the history of the language is commonly divided from the time of Alfred to the present? Name some of the chief writers belonging to each stage.

8. Turn the following passage into modern English:—

"Trew king, that sittes in trone,
Unto the I tell my tale,
And unto the I bid a bone
For thou art bute of all my bale:
Als thou made midelerd and mone,
And bestes and fowles great and smale,
Unto me send thi socore sone,
And dresce my dedes in this dale."

9. Give an account of the following words:—

minister
saint
preacher
bishop
porch
monastery
street
chester
basket
parsley
cloister
bother

10. Explain these terms:—Limes Saxonicus, Indo-European, Romance, Mœso-Gothic, Langue d'Oyl, Danelagh.

LOGIC AND MENTAL SCIENCE.

THREE HOURS ALLOWED.

LOGIC OF INDUCTION.

Mill's Logic.

1. Explain the difference between deductive and inductive reasoning, giving an example of each.

2. What is the ground on which all inductions are fundamentally based?

3. Is it an adequate explanation of causation to term it an *invariable sequence?* If not, why not?

4. What is the difference between observation and experiment? Wherein consists the special value of the latter?

5. Mill enumerates four methods of experimental inquiry. Explain the *two first*, with an example of each.

6. What is meant by the *explanation* of any law of nature?

7. How do you distinguish between a legitimate and an illegitimate hypothesis?

8. What is analogy? What is its special use in scientific researches.

MORAL PHILOSOPHY.

Stewart's Outlines.

1. Show how mental philosophy shared in the general reformation of the method of philosophical research introduced by Bacon.

2. Give Stewart's classification of the active powers of man.

3. Distinguish between appetite, desire, and affection.

4. What reason have we to believe that the moral faculty is an original principle of our nature?

5. What mental affections are we conscious of in contemplating a good or bad action performed by another?

6. What is Cudworth's and what Hutcheson's theory of the manner in which we become cognisant of moral distinctions?

7. By what line of argument does Stewart propose to prove the existence of a God?

8. Enumerate and explain two or three of the most important theories on the ground of morals.

9. What is Utilitarianism? What objections may be most obviously raised against it?

MENTAL PHILOSOPHY.

Hamilton.

1. What is meant by the presentative faculty? How is Hamilton's doctrine on this faculty distinguished from those of other celebrated philosophical writers?

2. Distinguish accurately between sensation proper and perception proper.

3. Give the reasons which have been urged to show, 1st, that *touch*, and 2nd, that *sight*, is the origin of our ideas of extension.

4. What is meant by the conservative faculty? Account for the fact of our retaining ideas and impressions without being conscious of them.

5. What is the reproductive faculty? Mention the principal laws of reproduction.

6. What does Hamilton mean by the representative faculty? Why is it so called? What phenomena are classified by Hamilton under it?

7. Distinguish carefully between the elaborative and regulative faculty. What are their respective functions?

FORMAL LOGIC.

1. What are concepts? Analyse the process by which they are formed in the mind.

2. Give the rules of a good division, and examples of false ones.

3. What is meant in logic by *definition?* Show what sort of terms admit of definition, and what sort do not, and why?

4. What are the predicables, and what the predicaments? What is the purport of each of these classifications

5. What is meant by the quantity, and what by the quality of a proposition? What symbols are used to designate them?

6. How many ways are there of "converting" a proposition? Give an example of each.

7. What are contraries, subcontraries, and contradictories? Give an example of each.

8. Explain what is meant by a syllogism, what by its mood, and what by its figure.

9. How many figures are there? Give the special rules of each, and justify them.

10. In what mood and figure are the following syllogisms drawn:—

> No vicious habit ought to be indulged.
> Some vicious habits promote a temporary interest.
> Some things which promote a temporary interest ought not to be indulged.
> Whatever requires to be known in order to salvation is revealed in the Scriptures.
> Whatever requires to be known in order to our salvation ought to be diligently studied.
> Some things which ought to be diligently studied are revealed in the Scriptures.

11. Give examples of the Ignoratio elenchi, Petitio principii, and Fallacia consequentis.

(*To be continued.*)

TRINIDAD PETROLEUM.

The following dispatch, addressed by Governor Gordon, of Trinidad, to the Duke of Buckingham, has been forwarded to the Secretary of the Society of Arts, by order of the Board of Trade:—

9th March, 1868.

MY LORD DUKE,—Your Grace does not require to be informed that Trinidad contains vast deposits of pitch and asphalt, and that many efforts have, at different times and in various manners, been made to apply this material to useful objects.

2. Experiments lately conducted in England would appear to show that the bitumen of what is called the Pitch Lake may be successfully and profitably employed as a gas-producing material. With these experiments, however, I have no present concern.

3. Attention has also been, for some time past, directed to the preparation from this substance of a fuel, to be used either together with coal or in substitution for it.

4. The different asphalt fuels which have been hitherto prepared, have generally been found liable to adhere to the grating bars of the furnace in which they were consumed, and also to melt or run when exposed to a high degree of heat.

5. It occurred, nearly simultaneously, to gentlemen in England, France, and this island, that these defects might be obviated by a mode of preparing the fuel which should insure the equal action of the fire upon all its particles. The same idea had been entertained, and on a small scale successfully applied, more than seven years ago by a gentleman in this island, now dead, but his experiments do not appear, either in the island or out of it, to have attracted the attention they deserved.

6. Struck by the fact that, whilst their mode of effecting it differed, the principle was the same in several plans submitted to me, I directed the preparation, at the Royal Gaol, of a few tons of fuel, under the superintendence of a gentleman who has long devoted himself to the examination of questions connected with the Pitch Lake. The bitumen was mixed in certain proportions with charcoal, was ground, and then pressed dry into bricks, about one foot in length, four inches broad, and three inches deep.

7. Commander Chimmo, R.N., was so obliging as to allow this fuel to be tried on board H.M.S. *Gannet* during a day's cruise. I enclose for your Grace's information the report of the engineers of that vessel, made after the trial, and transmitted to me by Commander Chimmo.

8. The *Gannet* got under weigh at 8 a.m. on the 21st ult., and returned to her anchorage off Port-of-Spain at 6 p.m., having in the interval run down round the island of Patos, a distance of thirty miles, and lain-to for a short time off that island, off the entrance to the Boca Grande, and off the island of Chacachacare.

9. At first coal and the asphalt fuel were burnt in equal proportions, but the result was not equal to that produced by the consumption of coal alone. Subsequently the proportion of 35 per cent. of fuel to 65 per cent. of coal was maintained, and, thus combined, the number of revolutions obtained, and the pressure of steam raised, were fully equal to what they would have been had coal only been used.

10. The mode of preparation adopted proved completely successful in overcoming the defects to which I have alluded. The fuel showed not the smallest sign of adhesion to the bars, or of melting, any part of the day, and though a small amount of what is termed "clinker" was produced, it was not greater than may often be found in ordinary steam coal.

11. It may, therefore, I think, safely be assumed that, in these proportions, an asphalt fuel may safely and usefully be employed, whilst, as it can be delivered here at certainly half the price of coal, there is no doubt that its employment, even in these proportions, would insure a considerable saving of expense. But when it is considered that the furnaces of the *Gannet* are particularly ill-suited to the consumption of asphalt, which requires a strong draught to secure its regular and rapid consumption, and also that the whole of the fuel employed on this occasion was prepared by hand, and consequently wanted that complete and uniform pressure needed to effect its thorough compression, and to remove from it all moisture, there can be no reasonable doubt that, under more favourable circumstances, the proportion of asphalt fuel, which may with advantage be mixed with coal, might be largely increased.

12. The only unfavourable point in the report is the fact that, whilst the consumption of the mixed fuel per indicative horse-power per hour was 4·35 pounds, the average consumption per indicated horse-power per hour of six different kinds of coals in the same furnaces (but probably at sea with more wind than at the day of trial inside the Gulf of Paria, where it was nearly calm in the morning, and where only a slight breeze blew in the afternoon) was 3·61 pounds, showing a deficit of ·74, or nearly three-quarters of a pound in the mixed fuel per horse-power per hour. If, however, the ashes which the engineers found and removed, and which consisted of half-burnt asphalt fuel, had been burnt off, and sent through the chimney, which can be done with a stronger draught, or more complete exclusion of all moisture by pressure applied by machinery, these three-quarters of a pound per indicated horse-power per hour would have been also utilised, *i.e.*, the mixed fuel would have given the same average as the six different kinds of coals mentioned.

13. Contrary to expectation, the smoke produced by the fuel proved to be lighter in colour and less dense in volume than that of ordinary coal.

14. Should your Grace see no objection to such a course, I should feel obliged if your Grace would direct the information contained in this despatch to be communicated to some of the scientific bodies interested in such subjects, and to give it such publicity as your Grace may consider not inconsistent with propriety.

I have, &c.,
(Signed) Arthur Gordon.
His Grace the Duke of Buckingham and Chandos, &c.

Report on Patent Fuel.

1. Primed laid fires and got up steam, in port boiler, with patent fuel alone, quantity 10 cwt.; time occupied in getting up steam, one hour and thirty-five minutes. Primed laid fires and got up steam, starboard boiler, with equal portions of patent fuel and coals; quantity 6 cwt. of each; time in getting up steam, fifty minutes. After steam being up, equal portions of patent fuel and coal were used in both boilers; proceeded full speed, draught plates taken down; height of steam-gauge 10lbs.; revolutions, 69; consumption, 7 cwt. of patent fuel and 7 cwt. of coal per hour; consumption, per indicated horse-power, per hour, 4·94lbs.

2. Fires cleaned out, using 60lbs. of patent fuel to 112lbs. of coal, took out two furnace-bars in each furnace to allow a greater current of air, which was a decided improvement in the brightness of the fires; the pressure now rose to the proper working height, viz., 13lbs., and kept steady; revolutions, 73½; consumption per hour, 5 cwt. of patent fuel, and 10 cwt. of coal; consumption per indicated horse-power per hour, 4·35lbs.; average consumption per indicated horse-power per hour of six different kinds of coals, 3·61lbs. No adhesion to the bars except a small amount of clinker, which caused the fires to be raked about, thereby causing about 25 per cent. of ashes. The ashes consisted of half-burnt patent fuel. It is my opinion, if greater space be left between the furnace-bars, so as to admit a greater current of air, nearly the whole of the ashes would be consumed. The amount of smoke remained about the same as when using coal alone; if anything, rather less, and of a lighter colour, the deposit of soot over the average being about six per cent.

Office of the Committee of Privy Council for Trade,
Whitehall, 24th April, 1868.

Sir,—I am directed by the Lords of the Committee of Privy Council for Trade to transmit to you, for the information of the Society of Arts, the enclosed copy of a dispatch that has been received from the Governor of Trinidad relative to some experiments that have been made in the use of fuel manufactured from the bitumen of Trinidad.

I am, Sir, your obedient servant,
Robert G. W. Herbert.
The Secretary Society of Arts, John-street, Adelphi.

In reference to this dispatch Mr. B. H. Paul writes as follows:—

8, Gray's-inn-square, 18th May, 1868.

Sir,—I have read the report of results obtained with fuel made of Trinidad pitch and charcoal, and herewith return it to you. If this fuel can be delivered on board at half the cost of coal in Trinidad, it will probably be useful. I would suggest, however, that its utility might be increased if the large amount of earthy material in the pitch could be separated in the manufacture of the fuel. This earthy material, which leaves an incombustible ash, amounts to about 25 per cent., according to analysis I have made of the Trinidad pitch, and it is to the presence of this material that I should ascribe the difference in the rate of consumption per indicated horse-power, of the prepared fuel as compared with coal, amounting to about ¾ of a pound per indicated horse-power per hour,

Yours, &c.,
B. H. Paul.
P. Le Neve Foster, Esq.

PARIS SCHOOLS OF DRAWING AND SCULPTURE.

The distribution of prizes awarded to the pupils of the Municipal School of Drawing and Sculpture, directed by M. Justin Lequien, took place the other day, when M. Robert-Fleury, the artist, presided and addressed the meeting. He expressed the great interest which he felt in the Paris schools of drawing and sculpture, and especially in that directed by M. Lequien, and then proceeded to sketch the growth and working of such schools. Before 1830 only one school of art existed for the working classes; this was founded by letters-patent of Louis XV.; what has been done since in this way was recently illustrated in the Exhibition of 1867. There are at the present moment fifty evening schools of art in Paris, where more than four thousand pupils can study; the models chosen, with care by a commission, are sent to all the schools; rewards are given by the municipal authorities, and the most meritorious pupils receive prizes of honour from the Emperor. The administration of the Beaux Arts lends its aid, and the Comte de Nieuwerkerke has presented a magnificent collection of plaster casts, figures, and ornaments, from which pupils may draw, model, and study the beautiful. Lastly, the Prefect of the Seine has caused large school-houses to be built to replace those whose accommodation had become insufficient. The school of the Rue des Petits Hotels, which is one of these, has room for three thousand pupils, and the municipality has spared nothing to render it a model establishment.

Having passed a high eulogium on the talent, the zeal, and the devotion of the masters generally, M. Robert-Fleury referred to the courses of geometric drawing, sculpture, and elementary anatomy, established by M. Lequien, and said that the education given in these schools answered all the wants of the industrial arts. The speaker then referred to the fact that M. Lequien had received medals from the Société d'Encouragement, and from the jury of one of the great London Exhibitions, and that four of the pupils of his school had received medals in London, and four at the competition of the Union Centrale des Beaux Arts of Paris. "Continue, then," said M. Robert-Fleury, "to profit by the encouragement which is offered to you; make free use of the advantages which the country and the Government place at your disposal, and all difficulties will give way before your perseverance. Imbibe as much as possible of the spirit of the best models of antiquity and of the *renaissance;* exercise yourselves in composition and invention; but remember that, though fancy is admissible in industrial art, it should never overstep the limits of good taste."

M. Robert-Fleury then uttered a wholesome warning to the pupils whom he addressed, not to abandon industry for the Beaux Arts, properly so called, without the most mature reflection, and thus run the danger of failure. "Industrial art," he added, "offers ample scope for glory; it has the sympathy of all the world—the production of a potter of Athens finds passionate admirers. Anyone may be proud to add his name to the long list of famous art workmen. Believe me, industry offers a fine field for those who know how to distinguish themselves in it. Work, for labour is honourable; it renders men better, and therefore more capable of fulfilling all the duties of life. Develop your faculties by study, and raise industry to the level of art. Remember that the grand epochs which make the glory of nations are also those in which art and industry were at their apogee."

The above will show not only what is being done by the Paris authorities in the way of general art-education, but also the views that are entertained by enlightened men on the subject and effects of such teaching.

Commerce.

Russian Commerce.—In the *Journal* of the 19th June we quoted the official returns of the imports and exports of the Russian Empire, for the years 1866 and 1867, under the various classes of goods; we are now enabled to give, from the lithographic sheet of M. Bogdanoff, of St. Petersburg, the totals under the heads of the various countries, by which it will be seen that the growth of the commerce between Great Britain and Russia was more marked during the past year than that between the latter and any other state, with the single exception of Prussia. The following comparative table is given in millions of roubles:—

Imports from—

	1866.	1867.
Prussia	69¾	92
Great Britain	59½	75¼
France	10¼	14½
Austria	8½	12¾
Hanseatic towns	8¼	11½
Holland	10½	5
Italy	5½	3
Belgium	3	7
Turkey	5	5¼
United States	2¼	4½
Sweden and Norway	2⅓	3
Spain	1½	3½
Greece	1⅛	2½

Exports to—

	1866.	1867.
Great Britain	102	107½
Prussia	23	30
France	16¾	17¾
Austria	6	7¼
Turkey	9	6
Holland	5½	7
Germany	3¼	8
Italy	6	4
Sweden and Norway	4	5
Belgium	3	4½
Hanseatic towns	3¾	3¾
Moldo-Wallachia	2½	2¼
United States	1½	1¼
Denmark	1¼	1
Portugal	½	1½

Obituary.

Antonia Vechte, native of France, artist in gold and silver work.—Vechte has been surnamed the Benvenuto Cellini of France, and his works have a European reputation. Vechte was entirely a self-made artist; left an orphan at the age of nine years, with a sister dependent upon him, he became a bronze chaser, and worked to the age of twenty-five without his talent being noticed. In 1826 he was engaged on the bronze bas-reliefs of the Column Vendôme. In this work his talent appeared; but his fellow-workmen ignored his pretensions as an artist, and he remained for several years more a working chaser. He studied at home, and produced some remarkable works in iron casques and pieces of armour. One of these works at length attracted, by accident, the attention of an amateur, and his original talent was at length recognised. His principal works are: a silver vase, subject, "The Passions conquered," exhibited in Paris in 1848; "The Sword of the Comte de Paris;" a vase, subject, "Centaurs and Lapithæ;" and a coupe, "Harmony in Olympus." Three of these works attained him, in 1848, the great gold medal, the cross of the Legion of Honour, and an order for a grand vase. From 1850 to 1860 he worked in London. His productions were rewarded by medals of Honour at the Paris Exhibitions of 1855 and 1867, and the London Exhibition of 1862. Vechte was a man of modest and even timid disposition, and led the life of a laborious artist to the end. When asked, in 1848, what portion of his work he laid claim to, (it was entirely his own) he said, "I am a repousseur," and he is known in France still as Vechte the repousseur, just as Palissy is known as the potter. He died a short time since, at the age of sixty-nine, and leaves behind him two pupils, a daughter and a nephew.

M. Persoz, the elder, professor of chemistry as applied to dyeing, bleaching, &c., in the Conservatoire des Arts-et-Metiers of Paris, and director of the establishment attached to the Chamber of Commerce of Paris, for conditioning silks and wools, died at Paris on the 12th of September.

Notes.

CONSUMPTION OF WATER IN NEW YORK.—The *Engineer* says:—"The present consumption of water in New York averages 60,000,000 of gallons per day, or sixty gallons for each inhabitant This supply, after deducting the quantity necessary for extinguishing fires, for washing, and other purposes, would appear to be liberal, though not equal, if we may believe history, to that provided for the citizens of Imperial Rome, who were at liberty to use something like one hundred gallons per day each."

ERECTION OF A LIGHT-HOUSE ON THE COAST OF FRANCE.—The elegant iron light-house which was seen at the Paris Exhibition last year, is being erected on the spot for which it was constructed, the islet called the Roches Douvres, at the point of the Côtes du Nord, the scene of many serious accidents. The greatest precautions are being taken to secure the solidity of the structure, the base of which is being sunk more than three feet in the solid rock, and fastened by means of strong iron bars. In consequence of the violence of the sea, it has been found necessary to erect the station of the superintendent of the works on piles, raised several yards above the plateau, and consequently only accessable by means of a ladder.

THE MONT CENIS TUNNEL.—During the month of August the progress made at the Mont Cenis tunnel was 39·10 metres on the Italian side at Bardonnèche, and 49·65 metres at Modane on the French side, making in all an advancement of 89·75 metres. The position up to the 31st August was as follows:—

	Metres.
South end, Bardonnèche	5,161·10
North end, Modane	3,574·65
Total length of tunnel driven	8,735·75
Length remaining to be driven	3,484·25
Total length of tunnel	12,220·00

According to the report recently published by Signors Sommeillier and Graltoni, the engineers of this undertaking, the cost of the works during 1867 amounted, in round numbers, to 6½ millions of francs (£260,000), and the length driven was 1,512·10 metres. During the present year, up to 31st August, 889·10 have been driven, at a cost of about 4,850 francs per metre run.

REPORT ON THE WORKING OF A FRENCH LABORATORY OF RESEARCH.—M. Wurtz, dean of the faculty of medicine of Paris, has made a report on the working of the laboratory under his charge. The report is dated in May last, but is just published. It appears that nineteen young chemists frequented the laboratory, and occupied themselves in researches and experiments of the most varied kind, the greater part of which resulted in discoveries or observations found worthy of being communicated to the Academy of Sciences and the Chemical Society; the total result being eighty notes or memoirs which are not without influence in the progress of chemical science. A list is given of the researches made by twelve pupils, of whom three or four appear to be English or American. The dean notices some of the most remarkable results of these experimental investigations. The researches of two of the students relate to what is called the phenomenon of isomerism, that is to say, the state of substances which present like composition with different qualities. One paper refers to chloride of allyl. Another student succeeded in separating and clearly distinguishing two classes of ethers, the *cyanhydrique* and the *nitriles*, which had previously been considered identical, and also in discovering the base of cyanhydric acid. Other students succeeded in demonstrating the truth of the connection or resemblance supposed to exist between carbon and silicium, and even in obtaining new compositions in which an atom of carbon replaces and serves the purpose of an atom of silicium. A young German chemist, studying in the laboratory, proved that the brain and nerves contained an abundance of a definite and crystalisable substance, which he has named *protagon*, which seems to play an important part in nervous action. This substance is complex, and when treated with alkalies yields a basic substance, which M. Liebreich has named ***névrine.*** This same substance may be obtained from the liver, in which it exists in a separate condition. *Névrine* has also been produced artificially by the action of oxygen and olefiant gas on ammonia and other substances. Results such as these certainly give immense importance to the establishment of laboratories with which France now, as well as Germany, is occupied.

Patents.

From Commissioners of Patents' Journal, September 18.

GRANTS OF PROVISIONAL PROTECTION.

Aërated beverages, &c., apparatus for supplying the syrup in the manufacture of—2775—J. Adams and H. Barrett.
Aniline, preparation of a blue colour from—2725—J. H. Johnson.
Capstans—2753—W. T. Carrington.
Card cases—2749—H. M. Lee.
Compasses—2743—W. E. Newton.
Coppers or boilers—2757—J. C. Walker.
Engines, expansion—2769—J. Stewart and J. Nicholson.
Furnaces, &c.—2761—J. Jones.
Heckling and carding machines—2765—G. Lowry.
Jewellery, &c., indivisible pin to be used in fastenings for—2767—P. I. Soulage.
Knitting and knitting machinery—2755—A. V. Newton.
Looms—2723—T. Atherton and J. Atherton, jun.
Looms—2731—W. G. Cooper and R. Harrison.
Muffs—2751—J. Joynson.
Muffs, cuffs, and collars—2773—E. Johnson.
Packings, metallic spring—2777—A. M. Clark.
Pumps for lubricating and other purposes—2727—T. Butterworth.
Railroad tracks, frog-plates for the intersections of—2747—J. Wood.
Reaping and mowing machines—2739—T. Howcroft & A. McGregor.
Thermometers—2733—W. E. Newton.
Weights, raising and lowering—2737—J. Pickering.

PATENTS SEALED.

797. R. M. Chevalier.
836. F. Winser and I. Swindells.
850. T. Barnes.
856. E. K. Dutton and J. and H. Holme.
858. S. Bates and W. Redgate.
868. W. G. Beattie.
872. J. B. Handyside.
874. J. Petrie, jun.
880. J. Norman.
882. A. Baumann.
890. D. Greig.
902. J. Macneill.
906. J. M. Poisnel.
908. J. M. Poisnel.
914. W. Smale.
916. W. Clarke and E. Walker.
922. R. Townsend.
928. P. Hill.
934. E. Rowland and J. Dalton.
937. W. Richardson.
938. F. Warner & H. Chopping.
939. W. Hooper.
941. R. W. J. Trueman.
944. H. F. Shaw.
951. W. and C. E. Taylor.
953. J. H. Cooper.
954. C. Gunner.
966. J. G. Jennings.
968. R. G. Greenhow.
969. E. K. Dutton.
971. T. Pope.
972. W. R. Lake.
976. J. Brönner.
978. G. F. Guy.
979. C. N. Leroy.
982. C. de Bergue.
984. A. Barclay.
988. G. B. Paterson.
992. T. W. Fuller.
994. E. Gray.
995. E. Gray.
1000. R. Smith.
1002. J. Antill.
1004. R. Smith, jun.
1005. M. P. W. Boulton and J. Imray.
1009. A. McGlashan & J. Hendry.
1010. A. B. Wollaston and F. Stanbridge.
1011. J. Warburton, jun.
1013. W. Buck.
1014. T. Lane.
1015. C. E. Brooman.
1016. S. Fisher.
1019. W. Richardson.
1022. J. Anderson.
1023. J. Jameson.
1025. A. P. Price.
1026. W. P. Piggott.
1032. T. Bettney.
1052. G. Davies.
1056. W. E. Newton.
1080. F. Wirth.
1097. T. Couldrey, jun.
1105. J. Norris and T. Quarm.
1111. J. H. Dufort and D. Gance.
1120. W. E. Boardman.
2340. C. D. Abel.

From Commissioners of Patents' Journal, September 22.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

2372. W. Esson.
2383. J. C. Broadbent.
2426. J. Davidson.
2384. R. Fox.
2393. L. Villette.
2398. W. Porter.

PATENT ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

2285. G. Dixon.
2340. W. Clark.
2358. G. T. Bousfield.